CLAIMS

1. A method for creating a three-dimensional visual representation of an object having multiple resolutions, comprising the steps of:

retrieving coordinates of vertices for the object;

determining a collapse order for the vertices identified in the vertex list;

reordering the vertices identified in the vertex list responsive to the determined collapse order;

creating a vertex collapse list responsive to the collapse order where the vertex collapse list specifies, for a target vertex, a neighbor vertex to collapse to;

using the vertex collapse list and a level of detail to identify at least one display vertex of the object; and

rendering the display vertex to produce a three-dimensional visual representation of the object.

2. The method of claim 1 wherein determining the collapse order comprises the steps of:

determining a set of collapse paths;

selecting a collapse path from the set of collapse paths;

computing visual distortion factors for the selected collapse path;

responsive to the computed visual distortion factors, determining a collapse value for the selected collapse path;

repeating selecting a collapse path, computing visual distortion factors, determining a collapse value for each collapse path;

selecting a next vertex to be collapsed as a vertex having a collapse path causing the least visual distortion to the object;

collapsing the next vertex to be collapsed along the corresponding collapse path; and

repeating the above steps until a minimum resolution level is attained.

3. The method of claim 2 wherein computing visual distortion factors comprises the steps of:

computing an area change factor for the selected collapse path;

computing an angular deviation factor for the selected collapse path; and

computing a local volume change factor for the selected collapse path.

4. The method of claim 3 wherein the computing an area change factor for each collapse path further comprises:

computing an area of the object after collapsing the target vertex along the collapse path; and

subtracting the computed area from an area of the object prior to the collapse.

5. The method of claim 3 wherein the computing a volume change factor for the selected collapse path comprises:

computing a volume of the object after collapsing the target vertex along the collapse path;

subtracting the computed volume from a volume of the object prior to the collapse.

6. The method of claim 5, wherein the step of computing a volume further comprises:

selecting the target vertex to be an apex for a pyramid;

forming a base of the pyramid from a triangle connecting three consecutive neighbor vertices to the target vertex;

computing a volume of the pyramid;

constructing a next pyramid from a next set of three consecutive neighbor vertices;

computing a volume of the next pyramid;

repeating the constructing a next pyramid and computing a volume steps for all unique three consecutive neighbor vertex sets; and

summing the volumes of the pyramids to obtain a volume of the object.

7. The method of claim 2 further comprising the step of receiving an input from a user specifying a priority weight for a visual distortion factor, and the determining a collapse value step further comprises, responsive to the computed visual distortion factors and priority weights, determining a collapse value for the selected collapse path.

8. The method of claim 2 wherein, responsive to collapsing the next vertex to be collapsed along the corresponding collapse path, collapse paths local to the next vertex are identified and the computing visual distortion factors for the selected collapse path

and the determining a collapse value for the selected collapse path steps are repeated only for the local collapse paths.

9. The method of claim 2 wherein determining a set of collapse paths further comprises:

selecting a target vertex;

receiving input specifying a maximum number of neighbor vertices for a target vertex;

identifying a number of neighbor vertices, responsive to the received input;

determining a collapse path responsive to coordinates of the target vertex and an identified neighbor vertex;

repeating the determining step for all identified neighbor vertices;

repeating the selecting a target vertex, identifying, determining, and repeating steps for a plurality of vertices.

10. The method of claim 2 further comprising the steps of:

responsive to selecting a collapse path, displaying the object prior to collapsing the object along the selected path;

collapsing the object along the specified path;

displaying the object after being collapsed along the specified path;

responsive to receiving an input selecting the collapse path, storing the collapse path and corresponding vertex on the collapse order list as the next vertex to be collapsed.

11. The method of claim 1, further comprising receiving an input specifying a set of minimum vertices, and the determining collapse order step further comprises determining a collapse order in which the specified set of minimum vertices are not collapsed.

12. The method of claim 1 wherein multiple resolution levels of the object exist, further comprising the steps of:

ordering the resolution levels from highest to lowest resolution;

selecting a highest resolution level for collapsing;

the determining a collapse order step comprises determining a collapse order for the highest resolution level, wherein vertices in the next lowest resolution level are not collapsed; and

repeating the selecting and determining steps for each resolution level.

13. The method of claim 1 wherein the vertex coordinates are associated with vertex attributes.

14. The method of claim 2 wherein the vertices have coordinates in a texture map, further comprising the steps of:

responsive to a selected collapse path collapsing a first vertex into a second vertex to create a new vertex, assigning the texture map coordinates of the second vertex to the new vertex;

responsive to the first and second vertex being on an edge of a texture discontinuity, identifying the collapse path as a collapse path not to be used.

15. The method of claim 2 wherein the vertices have coordinates in a normal map, further comprising the steps of:

responsive to a selected collapse path collapsing a first vertex into a second vertex to create a new vertex, assigning the normal map coordinates of the second vertex to the new vertex.

16. The method of claim 2 wherein the vertices have coordinates in a color map, further comprising the steps of:

responsive to a selected collapse path collapsing a first vertex into a second vertex to create a new vertex, assigning the color map coordinates of the second vertex to the new vertex; and

responsive to the first and second vertex being on an edge of a color discontinuity, identifying the collapse path as a collapse path not to be used.

17. A method for displaying an object, wherein a vertex list and a neighbor list is stored for the object, and vertices in the vertex list are identified by a collapse priority, and the neighbor list identifies the path of a collapse for the vertices, comprising the steps of:

performing a collapse of the object responsive to the vertex list and neighbor list;

storing vertex information for each collapse level, wherein the vertex information indicates which vertices exist in the object in the collapse level immediately higher and lower than the current collapse level;

receiving input requesting a collapse level for the object;

responsive to the requested collapse level requiring a higher resolution than a current collapse level, adding vertices to the vertex list for the object responsive to the vertex list and stored vertex information;

responsive to the requested collapse level requiring a lower resolution than a current collapse level, collapsing vertices in the vertex list of the object responsive to the vertex list and stored vertex information; and

rendering the vertices in the vertex list to produce a three-dimensional visual representation of the object.

18. The method of claim 17 further comprising the step of:

storing extended collapse information, wherein the extended collapse information includes triangle connectivity information for the vertices.

19. A method for displaying an object, wherein a vertex list and a neighbor list is stored for the object, and vertices in the vertex list are identified by a collapse priority, and the neighbor list identifies the path of a collapse for the vertices, comprising the steps of:

performing a collapse of the object responsive to the vertex list and neighbor list;

storing vertex information for each collapse level, wherein the vertex information indicates which vertices exist in the object in the collapse level immediately higher and lower than the current collapse level;

analyzing the object to determine a collapse level;

responsive to the determined collapse level requiring higher resolution, adding vertices to the vertex list for the object responsive to the vertex list and stored vertex information;

responsive to the determined collapse level requiring a lower resolution, collapsing vertices in the vertex list for the object responsive to the vertex list and stored vertex information; and

rendering the vertices in the vertex list to produce a three-dimensional visual representation of the object.

20. The method of claim 19 wherein the step of analyzing the object further comprises:

determining a velocity of the object; and

determining a projected area of the object.

21. The method of claim 20 wherein the step of analyzing the object further comprises:

determining the number of polygons currently being displayed;

comparing the determined number to a predefined target number of polygons; and

responsive to the number of polygons currently being displayed being less than the predefined number, adding polygons to the object.

22. The method of claim 19 wherein the step of analyzing the object further comprises:

determining a current frame rate;

comparing the current frame rate to a predefined frame rate; and

responsive to the current frame being less than the predefined frame rate, collapsing vertices in the object.

23. A method for transferring data across a remote connection, in a system in which a minimal resolution of an object is stored and separate packets of information comprising data for creating higher resolutions of the object are stored, comprising the steps of:

receiving a request for a transmission of an object to be displayed;

transmitting a minimal resolution version of the object responsive to the received request;

transmitting a packet of information comprising data for creating a next higher resolution of the object;

determining whether a target resolution of the object has been met; and

responsive to a target resolution of the object not being met, repeating the transmitting a packet of information comprising data for creating a next higher resolution of the object step.